CLAIMS

1. A method for determining alignment parameters for positioning each of a plurality of processing areas arrayed on an object with respect to a predetermined processing position, which method for determining the alignment parameters comprises

a first step of performing position measurement for any sample points set in each processing area under predetermined alignment parameters through opto-electric detection and statistical processing based on measured positions and design positions of said sample points to obtain reference computation results,

a second step of positioning and processing each processing are at said predetermined processing position based on said reference computation results, then measuring the processing error of said processing area to obtain reference processing results,

a third step of changing at least part of said predetermined alignment parameters and performing position measurement of any sample points set in each processing areas and statistical processing based on the measured positions and design positions of said sample points to obtain comparative computation results, and

a fourth step of calculating said processing

error for each processing area, estimated when assuming said positioning and processing said processing area at said predetermined processing position based on said comparative computation results, using said reference computation results, said comparative computation results, and said reference computation results.

2. The method for determining alignment parameters as set forth in claim 1, further comprising,

in said third step, changing the alignment parameters in a plurality of ways to obtain a plurality of comparative computation results,

in said fourth step, converting said reference processing results based on the differences between said reference computation results and said comparative computation results to calculate a plurality of estimated processing errors, and

further has a fifth step of comparing the plurality of estimated processing errors calculated at said fourth step and said reference processing result to obtain a comparison results and determining said alignment parameters based on the comparison results.

3. The method for determining alignment parameters as set forth in claim 2, further comprising, in said fifth step, determining the optimal alignment parameters based on at least one of the average value

and standard error of the processing error for each processing area according to said reference processing result or said estimated processing error.

4. The method for determining alignment parameters as set forth in claim 1, further comprising, in said third step, changing variable first alignment parameters of any sample point among said alignment parameters without requiring repeat opto-electric detection so as to calculate said comparative computation results.

5. The method for determining alignment parameters as set forth in claim 4, wherein said first alignment parameters include at least one of the combination used in sample points opto-electrically detected at said first step, the processing parameters of the signal waveforms obtained by the opto-electric detection at said first step, the statistical processing model used at the time of said statistical processing, and the amounts of correction to be added to the measurement positions of the sample points opto-electrically detected at said first step.

6. The method for determining alignment parameters as set forth in claim 1, further comprising, in said third step, changing second alignment parameters, among said alignment parameters, requiring

repeat opto-electric detection of said sample points separate from the opto-electric detection at said first step so as to calculate said comparative computation results.

7. The method for determining alignment parameters as set forth in claim 6, wherein said second alignment parameters include at least the type, number, and layout of said sample points, illumination parameters for illuminating said sample points at the time of said opto-electric detection, the state of focus at the time of said opto-electric detection, and the type of alignment sensor performing said opto-electric detection.

8. The method for determining alignment parameters as set forth in claim 1, wherein said third step includes

a sixth step of using signal waveforms obtained by said opto-electric detection at said first step to change at least part of said predetermined alignment parameters and obtain a plurality of said comparative computation results and

a seventh step of comparing the plurality of comparative computation results obtained at said sixth step and said reference computation results and selecting candidates of said comparative computation

results to be used in said fourth step based on said comparison results.

9. The method for determining alignment parameters as set forth in claim 8, further comprising, in said seventh step, selecting said candidates based on residual error components of said comparative computation results.

10. An exposure method for exposing and transferring patterns of a mask on a plurality of shot areas arrayed on a substrate, wherein

said exposure method performs position measurement for sample points set in each shot area serving as a processing area by opto-electric detection using optimal alignment parameters determined by the method of determination of the alignment parameters according to the first aspect of the present invention and statistical processing based on measured positions and design positions of said sample points and successively positions said shot areas with respect to an exposure apparatus serving as said predetermined processing position and exposes each shot area based on the computation results.

11. An apparatus for determining alignment parameters for positioning a plurality of processing areas arrayed on an object with respect to a

predetermined processing position,

said apparatus for determining alignment parameters having

a reference computation result fetching means for performing position measurement for any sample points set in each said processing area under predetermined alignment parameters via opto-electric detection and statistical processing based on measured positions and design positions of said sample points to obtain reference computation results,

a reference processing result fetching means for measuring the processing error for each processing area to obtain reference processing results after positioning and processing said processing area at said predetermined processing position based on said reference computation results,

a comparative computation result fetching means for changing at least part of said predetermined alignment parameters and performing position measurement of any sample points set for each said processing area and statistical processing based on measured positions and design positions of said sample points to obtain comparative computation results, and

a processing error calculating means for calculating said processing error for said processing

areas estimated when assuming positioning and processing said processing areas at said predetermined processing position based on said comparative computation results using said reference computation results, said comparative computation results, and said reference processing results.

12. The apparatus for determining alignment parameters as set forth in claim 11, wherein

said comparative computation result fetching means changes said alignment parameters in a plurality of ways to obtain a plurality of said comparative computation results,

said processing error calculating means converts said reference processing results and calculate said estimated processing error based on the differences between said reference computation results and said comparative computation results, and

provision is further made of a parameter determining means for comparing the plurality of estimated processing error calculated by said processing error calculating means and said reference processing result and determining said alignment parameters based on the comparison results.

13. An exposure apparatus for transferring by exposure patterns of a mask on a plurality of shot areas

arrayed on a substrate,

said exposure apparatus

provided with the apparatus for determining alignment parameters according to claim 12,

performing position measurement for any sample points set for each shot area serving as a processing area by opto-electric detection using optimal alignment parameters determined by the apparatus for determination of the alignment parameters and statistical processing based on measured positions and design positions of said sample points, and successively positioning said shot areas with respect to said exposure apparatus serving as said predetermined processing position and exposing each shot area based on the obtained computation results.

14. The exposure apparatus as set forth in claim 13, which

apparatus uses as an object a device production substrate to which device patterns formed on said mask transferred by exposure,

said comparative computation result fetching means performs said position measurement and statistical processing for said device production substrate while changing said alignment parameters in a plurality of ways to obtain a plurality of said comparative computation results, and

said apparatus for determining alignment parameters compares said plurality of comparative computation results and said reference computation results and determines said alignment parameters based on said comparison results.

15. The exposure apparatus as set forth in claim 14, wherein said apparatus for determining alignment parameters determines said alignment parameters based on random residual error components of said comparative computation results.

16. The exposure apparatus as set forth in claim 15, which, when a random residual error component exceeds a predetermined allowable value,

excludes said device production substrate from the substrates for transfer of said device patterns by exposure or makes said comparative computation result fetching means change said alignment parameters for said position measurement and statistical processing.